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The role of semantic and syntactic components in the language ability of schizophrenics.

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The Role of Semantic and Syntactic Components in the Language Ability of Schizophrenics

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Introduction

The purpose of this study was to investigate two possible areas of deficit in the language ability of schizophrenics. A great deal of attention, both clinical and empirical, has been given to the abnormalities of language in schizophrenia. The present study was an attempt to identify more exactly the manner in which schizophrenic language is deviant by investigating the effects of two factors which have been shown to be of primary importance in normal language usage. These factors are, first of all, word meaning or the semantic component of language, and secondly, grammatical structure or the syntactic component. They were investigated by means of an immediate recall task using auditory verbal stimuli which has been shown capable of identifying each of these factors with normal subjects, but had not been previously used with schizophrenics. Furthermore, two groups of schizophrenics were used, good premorbids and poor premorbids.

In addition to the theoretical significance of more exactly determining the nature of schizophrenic language, such an investigation has its practical aspects. As McGhie (1966) has observed, in the individual treatment of the schizophrenic patient, one of the main aims is to establish better communication with him. An understanding of the

basic perceptual and cognitive difficulties with which the schizophrenic is faced leads to an establishment of better communication and facilitates the development of a good relationship with the therapist. Studies such as the present one might contribute to such an understanding.

Clinical Observations of Schizophrenic Language

Historically, the peculiarities of language in schizophrenia has drawn considerable attention because of its diagnostic as well as theoretical significance. A few of these more clinically oriented observations would seem particularly relevant to this study. In his pioneering work, Bleuler (1950) placed as one of the fundamental symptoms the disorder of the process of association, as inferred from the verbalizations of his patients. On the other hand, Cameron (1938) noted several types of distortion in schizophrenic language. One form of distortion involves the use of an approximate but related term for the more precise term that a normal adult would use. Another relevant phenomenon which he describes consists of a juxtaposition of verbal elements without adequate linkage between them, similar to the distortion seen in dreams. The first of these distortions could be viewed as an impairment of the meanings of words and the second as an impairment of grammatical usage.

Two classical features of schizophrenic language, seen most often in severe cases, are "word salad" and neologisms.

Arieti (1955) interprets "word salad" as a process in which the elements of a sentence are replaced by other elements according to a primitive process of identity, thus, making up sequences of words which either cannot be understood, or are understood only with great difficulty by the listener. He even raises some doubt as to whether or not the patient himself understands what he is saying. Similarly, he views the neologisms of the schizophrenic as a product of the composition or combination of different verbal symbols.

The deficit in verbal ability is viewed by Arieti as part of a change in the more general process of symbolizing, a change which involves the loss of the introjected symbols which originate from others and the replacement with more primitive ones. He termed these "paleosymbols", that is, symbols which the patient himself creates and which have no consensual validation, but which, on the other hand, are not completely original or private, but use remnants of common symbols. In addition, he describes a reduction in the connotation power, a process in which the verbal symbols cease to be representative of a group or of a class, but are representative only of the specific objects under discussion. Under this somewhat broad theoretical framework could be subsumed a variety of more specific impairments of word usage and word meaning.

In order to evaluate fully both the nature and the extent of the disruptions and distortions of schizophrenic

verbal behavior, it would seem necessary to examine those aspects of normal language which seem most relevant to the disorder. As can be seen from the above clinical observations, the two major features would seem to be the breadth and content of a verbal symbol, i.e., the meaning of a work or the semantic factors, and the appropriate organization of verbal symbols, i.e., the grammatical or syntactic factor.

Semantic and Syntactic Factors in Normal Language

The study of semantic and syntactic factors in language actually began with investigation of the more general subject of verbal context or contextual constraint. Verbal context is the extent to which the choice of a particular word depends upon the words that precede it. Miller and Selfridge (1950) constructed a series of test materials which varied the degree of contextual constraint over eight levels ranging from randomly assembled words to standard English text. They found that the ability to repeat strings of words in an immediate recall task increased as a function of the order of approximation to the structure of English and decreased as a function of the length of the string. Also, they observed that the longer the passage the greater is the usefulness of the contextual associations or bonds between words. They interpreted the results as indication that meaningful material is easy to learn not because it is meaningful per se, but because it preserves

the short range associations that are familiar to the Ss. Nonsense materials which retain these short range associations in sufficient degree are also easy to learn. As will be seen later, approximations to English as used by Miller and Selfridge and the subsequent speculations in terms of short term associations, do not sufficiently identify the factors involved in the learning of meaningful materials and the more general subject of language usage. However, the Miller and Selfridge study represented a substantial beginning in the area.

A replication of the Miller and Selfridge work (Richardson and Voss, 1960) which corrected for certain sources of confounding error and employed an improved statistical analysis, supported their findings in full. Knox and Wolf (1965) tested several methods of presentation in an extension of the Miller and Selfridge experiment. They found no significant differences between aural presentation as previously used and two types of visual presentation. Once again, the basic findings were supported.

The Miller and Selfrdige materials, or variations of them, have been used as independent variables in studies of several areas such as memory, meaningfulness, and eye-voice span. Noting this fact, Salzinger, Portnoy, and Feldman (1962) tested to see if the various levels of approximation to English were equidistant. More importantly, they also tested the contribution of syntax to performance on the

materials. They found, first of all, that the assumption of equal distances between consecutive orders of approximation was not tenable, thus casting some doubt on the inferences which can be made with the tool. Secondly, they employed a system of grammatical classification (roughly similar to parts of speech such as nouns, verbs, etc.) as a measure of amount of syntactic structure and added a measure of meaningfulness (Taylor, 1956). Their analysis indicated that improvement in performance was attributable primarily to increased syntactic structure between orders 1 and 2, and primarily to meaning of the word string from order 3 to standard English text. At order zero, i.e., random words, the influence of neither of these two factors was present. Thus, the contributions of syntax and meaning of the total string (rather than the more specific semantic factor) were identified.

An additional study which specifically investigated the contribution of the syntactic component, as opposed to the semantic component, in the recall of approximations to English, was conducted by Tejirian (1966). The results were in general agreement with Salzinger et al. By manipulating the test materials, it was found that alterations in semantic structure affected recall of only the fourth, fifth, and sixth orders of approximation. It was concluded that differences in syntactic structure alone accounted for the observed differences in recall between the first order

and the second and third, and that differences in semantic structure alone accounted for the errors beyond the third order.

The preceding two studies attempted to demonstrate the effects of semantic and syntactic factors in extensions of the original Miller and Selfridge experiment. Using a novel approach, Epstein (1961, 1962) studied the effects of syntactic structure alone on verbal learning. To do so, he devised a series of nonsense syllables which, by the addition of appropriate grammatical endings such as "ed" or "s", were readily perceived to be grammatically structured. By using nonsense syllables, he controlled for meaningfulness or semantic factors and familiarity. He found that syntactically structured material was acquired more rapidly than matched, unstructured material. He later confirmed his original findings, although he employed a serial as opposed to a simultaneous presentation of the syllables. Comparing the two forms of presentation, he concluded that the superiority of the syntactically structured materials depended on the structural character of a group of syllables which enabled them to be perceived as a unit, i.e., generalized linguistic form, rather than on sequential or semantic associations from syllable to syllable. He noted that studies using the Miller and Selfridge materials are somewhat ambiguous, based on the fact that an increasing approximation to English is almost always accompanied by an

increasing syntactic organization, a factor which he has demonstrated can independently facilitate acquisition.

Although much emphasis has been placed on syntactic and semantic factors in the learning of verbal materials, the subject of interest here is the more general one of evaluating the effects of these factors on the perception and use of language. Miller and Isard (1963) investigated the perceptual consequences of linguistic rules, specifically grammatical or syntactic, and semantic rules. They noted that anyone who speaks a natural language knows, at least tacitly, that successive words in that language are normally chosen subject to certain constraints. These constraints, emphasized in the Miller and Selfridge (1950) study, can be further classified according to their origins in the grammatical, semantic, or pragmatic rules of language, the first two being of interest here. To violate these rules is to invite misunderstanding and failure in communication. Furthermore, these rules must be known and respected by all users of the language, talkers and listeners alike. Their study was based upon the assumption that, in order to understand a spoken sentence, it is necessary to process the received acoustic signal according to these linguistic rules and that perception is more accurate when this processing can be performed in its habitual fashion. The linguistic rules will normally serve to limit the number of possible alternative messages from which a listener

must choose. Parenthetically, one can note the possible implications of identifying a breakdown in this process for understanding the language difficulties of schizophrenics.

In explaining the respective roles of syntactic and semantic factors, Miller and Isard propose that an important step in understanding any sentence is the determination of its phrase structure, and, in so doing, the listener, for example, will then be able to use his knowledge of English syntax to simplify his perceptual decision about what is being said. For example, only, certain classes of words can be substituted into the various positions in a sentence, so a listener's response at each position can be limited to a choice from the appropriate class, rather than from the total vocabulary of English. On the other hand, semantic rules determine the various meanings of a particular word, give some indication of the linguistic contexts in which each meaning would be appropriate, and designate the meanings that are mutually appropriate when the words enter into grammatical compounds. Miller and Isard felt that linguistic rules are involved in understanding the various utterances heard each day. Their purpose was not to test understanding, however, but to test the more specific function of speech perception as measured by an S's ability to repeat what he hears. The method employed was to systematically violate some linguistic rules and see whether or not such violations make the perceptual task more difficult.

To test these observations, Miller and Isard devised three sets of materials. The first set consisted of normal grammatical sentences. The second set was a group of semantically anomalous sentences which were created by interchanging words from the normal sentences that appeared in the same syntactic position. The third set contained ungrammatical strings of words produced by haphazardly permuting the positions of the words in the anomalous sentences in order to destroy the syntactic structure. The perceptual task involved the "shadowing" or immediate repetition of the word strings in the presence of varying levels of masking noise and with or without a preparatory set for type of word string. They found that learning to listen to the word strings in noise had a small effect relative to the substantial differences in performance attributable to semantic and syntactic conformity. Furthermore, both syntactic and semantic rules were operative in the results. The grammatically acceptable but semantically anomalous sentences were intermediate in difficulty, falling below the normal sentences and thereby showing the effect of violating the semantic rules, and falling above the ungrammatical word strings and thereby showing the effect of retaining the grammatical rules. Miller and Isard saw these findings as demonstrating that any description of speech perception must take into account the semantic and syntactic rules of language. They pointed out further that linguistic

rules, particularly syntactic and semantic rules, describe or define the socially accepted linguistic practices of a given community. Of interest to the present study is the manner in which a particular group, schizophrenics, may deviate from these socially accepted linguistic practices.

Extending this earlier work, Marks and Miller (1964) investigated the role of semantic and syntactic factors in the memorization of sentences. In this study, however, strings of words were constructed in which semantic and syntactic rules could be violated independently, an improvement over the Miller and Isard materials. Four types of word strings were employed; normal sentences, semantically anomalous sentences, ungrammatical word lists, and a fourth type, anagram strings, which were created by taking the normal sentences and scrambling the word order thus destroying the syntactic structure while retaining the semantic components. S's performance in a free recall type of learning situation was then compared for the various kinds of strings. They found that learning was most rapid for the normal sentences and most difficult for the word lists. The anomalous sentences and anagram strings consistently fell between the other two types with the relative difficulty of one over the other varying with the use of different scoring methods. Nevertheless, the results demonstrated that syntactic and semantic factors each facilitated learning. Marks and Miller felt that the results gave support

to the contention that syntactic and semantic rules have psychological as well as linguistic significance.

An important aspect of the Marks and Miller study is the development of a method for independently varying semantic and syntactic components and evaluating each by means of an immediate recall learning task. Just as the Miller and Selfridge (1950) materials were used as an independent variable in the investigation of a number of psychological processes, the Marks and Miller materials can be readily adapted to the investigation of other areas. In the case of the present study, they were used to investigate the role of semantic and syntactic components in the language of schizophrenics.

Semantic and Syntactic Factors in Schizophrenic Language

As Sullivan (1954) observed, when a person becomes thoroughly schizophrenic, instead of perfect English, all the agreed, authoritative, and demonstrably useful systems of phonetic combinations disappear. Laffal (1965), in his extensive observations of schizophrenic speech, placed the major emphasis on the semantic rather than the syntactic aspects. He felt that words are of primary importance because the psychological essence of language lies in meaning, which is contained, for the most part, in words. However, he pointed out that syntax becomes important psychologically insofar as it contributes to meaning by placing emphasis, pointing directions of action and modification, establishing

sequences and relationships, and otherwise organizing words. Following a basically analytical model, he felt that, for the schizophrenic, words become the magical incantations for thing-representations which his fantasy has uniquely constructed to fit his own needs without regard to reality and communal usage. Neologism and gibberish, disturbances mainly of semantics, may be understood as the appearance of disturbances designed to hide or disguise unacceptable material which is on the verge of obtaining conscious expression. Earlier, Freud (1915) had proposed that, in schizophrenic language, words are subjected to primary process distortion comparable to the distortion of dream images and that a single word, if suitable because of its many associative connections, may contain the condensation of a whole train of thought. Such a process would represent a severe disturbance of semantics.

In a more systematic study of schizophrenic language, Salzinger, Portnoy, and Feldman (1963) analyzed samples of monologues from schizophrenic patients using both a measure of readability and a grammatical analysis. They found that the speech of schizophrenics became less coherent over a short interval of time. The speech which followed closely after the instructions and introductory remarks was relatively coherent due, most likely, to the structure provided by the introduction and instructions. Later, when the patients' verbal behavior depended primarily upon the

contextual constraints, or the response produced stimuli which they provided for themselves, their speech became more difficult to understand. Salzinger et al. concluded that the language of schizophrenics was similar to normals only as long as the controlling stimuli were external. Also, they empirically demonstrated the relatively lower communicability of schizophrenic speech.

In a study which focused specifically upon vocabulary knowledge and usage, i.e., the semantic aspects of language, Moran (1953) tested a group of schizophrenics and matched normals on a battery of seven verbal tests built around a common core of 25 familiar words and measuring a variety of aspects of verbal usage. He found no difference between the groups in their ability to define words or the breadth of their understanding of the word meanings. He did, however, find significant differences between schizophrenics and normals in the conceptual level of the definitions and the ability to form concepts with the words, as well as the level of those concepts which were formed. More important, the two groups differed significantly in their ability to communicate with the words, ability to reason symbolically with the words (analogies test), and in their associations to the words. Thus, Moran's results would seem to indicate that schizophrenics at least have available to them the common definitions of words, but show an impairment in their ability to use the words in thinking and communication.

Based on a series of studies of word usage in schizophrenia, Chapman (1964) proposed a theory of schizophrenic verbal behavior emphasizing word meaning or semantics. According to his theory, schizophrenics' misinterpretation of the meanings of words arises in part from an excessive reliance upon the "stronger portions" of the denotation of a word, i.e., the most common meaning, with a relative neglect of the weaker meaning. The interpretation of words by normal persons reflects the use of the weaker as well as the stronger meaning. In contrast to the psychoanalytic viewpoint, he assumed that the meanings themselves are similar for schizophrenics and normals. He admitted the possibility, however, that schizophrenia produces, in addition, some increase of deviant meanings.

According to Chapman, the external stimuli from the context in which a word appears have an influence on which of the several meanings to a word are used to mediate an overt response. The most important of these contextual cues are other words. He felt that schizophrenics often fail to respond to the contextual cues which in normal persons have a restraining influence on the expression of response biases. Schizophrenics will guide behavior by the strongest normal mediating response. Thus, they do not use contextual cues when these are weak. When the cues are stronger, however, the schizophrenic will be more inclined to use them and their performance will approach that of normals. It should

be noted, at this point, that Chapman used chronic schizophrenics for his studies and for the theory which he derived from them. It would, perhaps, be more informative in studying the verbal behavior of schizophrenics to contrast the chronics with acutes or, using a related dimension, contrast poor premorbid schizophrenics with good premorbid schizophrenics.

While gathering material on disorders of attention and perception in schizophrenic patients, Chapman and McGhie (1961, 1962) noted that many of the patients commented on their difficulty in expressing their thoughts in speech and in comprehending the speech of others in conversation. In order to investigate these reports, a new study was initiated. Lawson, McGhie, and Chapman (1964) reviewed the clinical data and noted that the reports of these patients regarding their difficulty in speech comprehension suggested that the difficulties resulted, not from an inability to perceive the individual words which comprise a connected discourse, but from a deficiency in perceiving the words in meaningful relationship to each other as part of an organized pattern. In order to investigate this difficulty in dealing with the longer and more meaningful units of language, they turned to the Miller and Selfridge (1950) materials which contained increasing degrees of contextual constraint or meaningful organization from random words to standard English text. The patients used in the study were a highly select group,

consisting of the most cooperative and least deteriorated schizophrenics from previous studies. A comparison of performance on two lengths of passage (10 words and 20 words) indicated that the schizophrenic group did not experience any greater difficulty with increasing length than did the subjects in the normal group. More important, they found that not only did the schizophrenic group do worse than the normals on the test as a whole, but that their performance improved significantly less with increasing degrees of organization, than did the normals. In other words, the schizophrenic patients showed a relative inability to take advantage of the increasing levels of organization in the series of passages presented to improve their performance. Furthermore, at the first level of organization, i.e., random words, the difference between the two groups was not significant. At the next level of organization, however, the difference between the normal and the schizophrenic group was significant, and the differences at all subsequent levels were significant and increasingly larger.

Lawson et al. interpreted their findings in terms of a defect in the processes of attention, rather than a defect in language ability. They suggested that the schizophrenic patient is less able to carry out the normally automatic process of screening out the redundant words which occur in most verbal communications. If schizophrenics are particularly vulnerable to interference or distraction, the

redundant words might be expected to act as a distracting influence in their perception of the key words involved in a passage. In the more structured passages, the forgetting of a few key words would disrupt the recall of the passage as a whole.

An earlier study by Lewisohn and Elwood (1961) raised some doubt regarding the validity of the Lawson et al. findings and conclusions. They, too, employed the Miller and Selfridge (1950) materials to investigate the role of contextual constraints or organization in the disturbances of language in schizophrenics, but, in addition, used superior controls. They hypothesized that the disturbances in language of schizophrenics stems from a lack of acquisition of the contextual constraints, or what could also be called associational interdependencies, of language. More specifically, they postulated that these interdependencies are not so firmly established in schizophrenics as in non-schizophrenics. They used four groups of 20 Ss; medical convalescents, acute and chronic schizophrenics, and a non-schizophrenic psychiatric group. The Miller and Selfridge procedure was followed using the 20-word list. They found that the performance of the acute schizophrenics was very similar to that of the two control groups at all levels of organization. The chronic schizophrenics scored significantly lower at all levels than did the other groups and, in addition, showed significantly less improvement as a function of

increasing organization or contextual constraint. However, when a group of chronics were matched with a group of control Ss on the basis of WAIS Vocabulary scores, no significant differences in amount of improvement were found. Lewisohn and Elwood suggest that acute schizophrenics retain the culturally shared associational expectancies of language, and that this factor cannot be responsible for the disturbances in language observed in these patients. They further suggested the presence of an overall impairment factor in chronic schizophrenia which extends to all verbal performance measures.

The Lewisohn and Elwood (1961) study and the Lawson (1966), although approaching the question of the role of contextual constraints in schizophrenic language problems from different theoretical viewpoints, nontheless produced contradictory results. Although there is need to clarify this issue, it no longer seems adequate to simply test the effects of contextual constraints. As was seen earlier in the discussion of normal language, the role of contextual constraints can be further clarified by classifying their origins in terms of the semantic and syntactic rules of language. Also, an adequate tool for this purpose was developed by Miller and Isard (1963) and improved by Marks and Miller (1964). These latest developments in the study of language have not yet been applied to investigations of schizophrenia. Evidence from other areas of research

indicates that such an approach might prove fruitful. For example, the Moran (1953) and L. J. Chapman (1964) findings on word meaning in particular, as well as studies of verbal concept formation would seem to indicate a disruption in the semantic aspects of language in schizophrenia. Although little has been done regarding syntactic factors in schizophrenic language, work with normals such as that of Epstein (1961, 1962) has clearly demonstrated that syntactic factors are highly important in language usage in and of themselves. Finally, the investigation of semantic and syntactic factors could simply provide more detailed information on the difficulties which the schizophrenic may be experiencing in the perception and use of language.

Problem

The present study is a continuation of the investigation of language in schizophrenia. More specifically, it is an attempt to determine the relative influence of syntactic and semantic factors in schizophrenic speech perception and learning as measured by performance on an immediate recall task using auditory verbal stimuli. Unlike previous studies which have concentrated on the role of contextual constraints or organization, this study differentiates the two most important factors which underlie these constraints by using the appropriate test materials for the first time with a schizophrenic population. Also, the schizophrenics are divided into two groups, poor premorbids and good

premorbids, a division which has been shown to be meaningful in previous research and could have theoretical importance here.

The Ss were tested on four types of word strings. The first type, word lists, consisted of unrelated words and thus constituted a simple immediate recall task. It was expected that all three matched groups would be approximately equal on this task. A second type of word string, semantically anomalous sentences, consisted of sentences in which the grammatical structure or syntactic component was retained while the semantic component was eliminated. It was expected that the normals would be able to make use of the syntactic component to improve their performance over that of the word lists. If either or both of the schizophrenic groups were unable to improve their performance, then it would have been demonstrated that the syntactic component represents a distinct area of deficit in the language ability of schizophrenics.

In the same manner, the third type of word string, anagram strings retained the semantic component in that all the words were meaningfully grouped together, but eliminated the syntactic component by mixing the word order. Once again, if either or both schizophrenic groups were unable to make use of the presence of the semantic component to improve their performances, then this would be considered an area of deficit. Previous research would seem to indicate

that at least the poor premorbids and possibly the good premorbids would be significantly poorer than normals on this task. The fourth type of word string, normal sentences in which both syntactic and semantic components were present, was expected to differentiate the three groups significantly. Thus, the study attempted to identify more clearly the area of language difficulty which had been previously attributed to broad factors such as attention, or to quite specific factors such as word meaning.

Method

Subjects

Ss were thirty-two poor premorbid schizophrenics, thirty-two good premorbid schizophrenics, and thirty-two normals. The schizophrenic Ss were divided into poor and good premorbid on the basis of the Phillips Premorbid History Scale (Phillips, 1953). Normal Ss were chosen on the basis of their having no previous history of treatment for a psychiatric disorder. All three groups, consisting exclusively of males, were matched for age, WAIS Vocabulary subtest scores, and education. Interjudge agreement was better than 93%for both the WAIS Vocabulary and Phillips scores. The schizophrenic subjects were patients at the Veterans Administration Hospital, Northampton, Mass., and the Northampton State Hospital, Northampton, Mass. These Ss had no other pathology such as alcoholism, or brain damage. The normals were recruited from several communities in Massachusetts.

Test Materials

The materials devised by Marks and Miller (1964) were used. These consist of two separate, but parallel sets, each containing the four types of word strings. The first type consists of five normal sentences of five words each with identical syntactic structures (adjective-plural noun-verb-adjective-plural noun). The second type, anomalous

sentences, were derived from the normal sentences by taking the first word from the first sentence, second word from the second sentence, and so on. Thus, the derivative sentences remain syntactically identical to the normal sentences, but, because of the word substitutions, are semantically abnormal. The third type, anagram strings, was created by taking each of the normal sentences and carefully scrambling the word order, each sentence being scrambled differently in order to avoid any noticeable pattern, with care being taken that none of the scrambled sentences was grammatical. This process retained the semantic components of each sentence, but destroyed the syntactic structure. Similarly, the fourth type of word string, word lists, was formed by scrambling the word order of the anomalous sentences, thus preserving neither the syntactic nor the semantic components of the original normal sentences.

The words used in constructing the strings were not, in general, high frequency words. As Miller and Isard pointed out in their earlier study, high frequency words have multiple syntactic and semantic roles which they can play, so that scrambling or substituting them is less likely to produce semantically anomalous or ungrammatical derivative strings. The low frequency, and potential unfamiliarity, of the words was not a problem in the Marks and Miller (1964) study which used Harvard and Radcliffe students as Ss. However, a question was raised as to the applicability of these

materials with a less highly educated and less intelligent population. To answer this question, a pilot study was conducted as part of the current investigation following the Marks and Miller (1964) procedure, but using eight normal Ss, males and females, with no more than twelve years of education, and ranging in age from nineteen to fifty-two years. Examination of the data showed that the performance of the high school educated group generally paralleled that of the Marks and Miller Ss, but at a lower level. Of course, in the present study, all three groups were matched on vocabulary level and education. Therefore, any problems arising from potentially difficult materials were distributed equally across the three groups.

Procedure

Each group of five strings was recorded on magnetic tape by the experimenter. The groups were read at a rate of 5 words in $3\frac{1}{2}$ seconds, with 2 seconds between strings. Because five trials were run, a group of strings was recorded five times, the order of the strings within a group being varied from trial to trial according to a latin square design.

Ss were tested individually beginning with the WAIS Vocabulary subtest. Following the instructions and a brief sample problem, each S received an experimental task consisting of only one type of string. He was tested for five trials on a group of word strings from one set, then

tested for five trials on a parallel group from the other set. The order of presentation of the two sets was counterbalanced among the subjects receiving each type of string. On each trial, a subject listened to all five strings, then wrote down on an answer sheet, in any order, as many strings or parts of strings as he could recall. The instructions were tape recorded and read as follows:

> This is a memory test. When we begin, you will listen to a series of strings of words. These may sound unusual to you. You are to remember as many of these strings or parts of strings as you can. Now, look at the answer sheet. You see that, for each presentation, there are lines provided for each string and spaces for you to write as many words for each string as you can remember. If you are unsure of a word, please guess. Are there any questions? We will begin with a couple of sample strings.

All Ss selected for the study demonstrated on the sample strings that they fully understood the instructions. The experimental task began with the following words: "From now on, you will hear five strings at a time."

A separate answer sheet was given to a S for each trial. After the completion of five trials with the first set, S was told that he would now hear another group of strings and that the directions were the same. During the administration of the instructions, the experimenter carefully pointed out the various parts of the answer sheet. The aim in constructing the directions was to maintain brevity, clarity, and simplicity, rather than to anticipate any questions

which could be handled easily by the experimenter on an individual basis. Thus, the potential handicap of giving complex instructions to the schizophrenic S was minimized.

The sample strings were added to the procedure for two reasons. The first was to provide added insurance that any effects in the schizophrenic groups would not be due to a misunderstanding of the instructions. The second was to insure that all Ss, particularly the schizophrenics, would have an appropriate set before beginning the experimental task. Only two strings were given in the sample for the sake of simplicity, and to avoid any significant training effects. The sample strings were normal sentences. This fact should not differentially have been of advantage to those Ss who subsequently received normal sentences on the experimental task, since they were already accustomed, by day-to-day experience, to hearing normal sentences.

In order to test the ability of schizophrenic Ss to conform to the requirements of the experimental task, a second pilot study was conducted with schizophrenics of the same description as those used in the present study. Eight were selected, four poor premorbids and four good premorbids. Ss ranged in age from 20 to 43, in education from 10 years to 16 years, and in vocabulary scaled scores from 6 to 14. Examination of the data revealed that the schizophrenics performed best on the normal sentences, worst on the word lists, and intermediately on the anagram

strings and the anomalous sentences, which were almost equal. Although a direct comparison could not be made with the high school educated normals run previously, due to differences in procedure and lack of matching, a rough comparison indicated that the normals and the schizophrenics as a group showed different patterns of performance on the four types of word strings over the five trials. The comparison indicated that these differences were worth further exploration and analysis along the lines of the present investigation.

Regarding the question of motivation, the Ss of the two pilot studies were directly compared in terms of total time taken for the experimental task. Ss could take as much time as they wished in recalling the word strings. The average total time of the two groups (normals, 32.25 min.; schizophrenics, 29.00 min.) differed by only 3.25 min., a difference which could easily be accounted for by the greater amount recalled by the normals. The similarity in time, along with observation of the Ss during testing, indicated that the schizophrenics were not more inclined to give up easily. It was expected that, because of the straightforward nature of the task and relative shortness of the testing time, there would not be a significant motivational problem with the schizophrenic Ss. This expectation proved true in the main study in which only two schizophrenic Ss failed to complete the task, and not because of motivational problems.

Scoring

Three methods of scoring for correctness were used. The first scored words as correct if they occured together in a string, regardless of the position in the string in which Ss recalled them. A second and more stringent method considered a word as correct only if it was written as presented and in its correct position relative to the other words recalled in the string. Although the pilot studies showed very little difference between these two types of scoring, Marks and Miller (1964) found some variation between them. Finally, the number of total strings correct was scored.

Although all three methods of scoring for correctness provided the basic information sought in the study, the three methods differed somewhat in the type of information which they provided. The first method measured the effects of syntactic and semantic components upon simple recall and retention, i.e., the number of words which were available to S. The second method examined the effects of syntactic and semantic components upon the ability of Ss to recall words in correct relation to each other, a process which involves the use of a degree of organization. Similarly, the third method, total strings correct, measured the effects of the two components upon the perception and recall of the strings as complete units.

In addition, the data were scored for three possible types of errors. The first type, inversion, is defined as

the misplacing of a word within a string. Inversions are considered to be syntactic errors since they are related to word order. The second type, bound-morpheme error, refers to the omission or incorrect addition of prefixes and suffixes. These also are syntactic errors because they center around grammatical tags. The third type to be scored, intrusion, is defined as the introduction of a word into a string that does not belong in it, such as a word from another string. Intrusions are considered to be semantic errors, related to decisions as to which words may combine in a sentence. The use of these three types of error scores served as an additional measure of the role of syntactic and semantic factors in the recall of the four types of strings. Specifically, a comparison of the number of syntactic and semantic errors committed by each group of Ss on each of the four types of word strings was made. Two independent scorers, following the scoring system, agreed on 91.63% of a sample of 180 items.

Results

A separate analysis of variance was performed for each of the three methods of scoring for correctness. In each analysis, the data were analyzed with respect to adjustment group (poor premorbid schizophrenics, good premorbid schizophrenics, normals), type of word string (normal sentences, anomalous sentences, anagram strings, word lists), trials (1 through 5), and order of presentation (first, second). For the purposes of this study, the sources of variance of most interest are those which reflect differences between the three adjustment groups. Those sources of variance, though significant, which merely provide information regarding performance on the test materials, as well as certain second- and third-order interactions whose meaning is obscure, will not be discussed.

Analyses of Correctness Scores Over All Types of Word Strings

Results of the analysis of the words recalled correctly and in their correct position in a string showed a significant overall difference between the three adjustment groups ($p<.001$), as expected (Table 1.). Also as expected, there was a significant interaction between adjustment groups and types of word string ($p<.005$). An additional result of interest was a significant interaction between adjustment groups and trials ($p<.001$).

Table 1

Analysis of Variance for Words Correct and in Correct Position Over All Types of Word Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	2001.7000	23.5758******
Word Strings (B)	3	2637.8242	31.0681******
A x B	6	330.7935	3.8961*****
Ss/ A x B	84	84.9047	
Within			
Order (C)	1	84.0167	11.8631******
A x C	2	12.3952	1.7502
B x C	3	13.6247	1.9238
A x B x C	6	8.9483	1.2635
Ss x C/ A x B	84	7.0822	
Trials (T)	4	370.1831	89.1234******
A x T	8	26.7823	6.4480******
B x T	12	53.7928	12.9509******
A x B x T	24	9.1987	2.2146******
Ss x T/ A x B	336	4.1536	
C x T	4	.5579	.2384
A x C x T	8	6.2085	2.6526****
B x C x T	12	2.6812	1.1456
A x B x C x T	24	4.8142	2.0569*****
Ss x C x T/ A x B	336	2.3405	

**** $p<.01$
***** $p<.005$
****** $p<.001$

The results of the analysis of the words scored correct regardless of the position in which they were recalled in a string almost exactly paralleled those of the analysis of the words correct and in correct position (Table 2). Once again, there was a significant difference between the three adjustment groups ($p<.001$), a significant interaction between adjustment groups and types of word strings ($p<.005$), and a significant interaction between adjustment groups and trials ($p<.001$). The interaction between adjustment groups and order did not reach the required level of significance of .01 for the analysis of variance. Such a relatively conservative level has been chosen because of the somewhat large number of analyses which were required and, therefore, an increased probability of a significant result by mere chance. This procedure, together with a note of caution to the reader when considering a less outstanding or inconsistent finding, is meant to offset the error rate experimentwise.

The results of the analysis of total strings correct were in complete agreement with the other two methods of scoring for correctness on the variables of interest (Table 3). Since this measure is generally redundant with words correct and in correct position, and since sufficient information is provided by the two measures of scoring words correct, total strings correct will not be discussed further.

Table 2

Analysis of Variance for Words Correct Regardless of Position Over All Types of Word Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	2484.2559	27.7292******
Word Strings (B)	3	2555.8267	28.5280******
A x B	6	351.7200	3.9259*****
Ss/ A x B	84	89.5900	
Within			
Order (C)	1	136.5042	16.5149******
A x C	2	29.9706	3.6260
B x C	3	17.6861	2.1397
A x B x C	6	19.5521	2.3655
Ss x C/ A x B	84	8.2655	
Trials (T)	4	431.6377	95.0304******
A x T	8	37.0381	8.1544******
B x T	12	52.8730	11.6407******
A x B x T	24	12.2319	2.6930******
Ss x T/ A x B	336	2.5276	
C x T	4	0.7407	.2930
A x C x T	8	6.3576	2.5153****
B x C x T	12	3.8234	1.5127
A x B x C x T	24	6.1302	2.4253
Ss x C x T/ A x B	336	2.5276	

**** $p<.01$
***** $p<.005$
****** $p<.001$

Table 3

Analysis of Variance for Total Strings Correct Over All Types of Word Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	130.5375	8.4426******
Word Strings (B)	3	76.3292	30.7643******
A x B	6	14.0259	5.6531******
Ss/ A x B	84	2.4811	
Within			
Order (C)	1	0.8167	2.8201
A x C	2	0.3885	1.3415
B x C	3	1.1694	4.0380
A x B x C	6	0.1621	.5597
Ss x C/ A x B	84	2.4811	
Trials (T)	4	2.0766	10.1396******
A x T	8	0.7438	3.6318******
B x T	12	1.9966	9.7490******
A x B x T	24	0.6648	3.2461******
Ss x T/ A x B	336	0.2048	
C x T	4	0.0589	.5404
A x C x T	8	0.1932	1.7725
B x C x T	12	0.1233	1.1312
A x B x C x T	24	0.1110	1.0183
Ss x C x T/ A x B	336	0.1090	

**** p<.01
***** p<.005
****** p<.001

Of primary interest in the analyses presented thus far was the groups-by-word strings interaction. It is this interaction which would indicate if there are any differences in the performances of the three adjustment groups due to the syntactic and semantic components as varied in the construction of the four types of word strings. To examine this interaction further, four subsequent analyses of variance were performed, one on each of the four types of word strings. These subsequent analyses were performed for two of the three methods of scoring for correctness.

Analyses of Correctness Scores on Each Type of Word String

The results of the analysis of performance on the normal sentences for words correct and in correct position (Table 4) showed a significant difference between the three adjustment groups ($p<.005$). Subsequent examination of the group means (Table 12) using Sheffé's multiple comparison method demonstrated that, as expected, the poor premorbid schizophrenics performed significantly lower than the normals ($p<.10$, Sheffé's suggested level of confidence). The good premorbid schizophrenics also performed significantly lower than the normals ($p<.005$). However, there was no significant difference between the poor premorbid schizophrenics and the good premorbid schizophrenics with the mean of the "goods" falling below that of the "poors." There was also a significant interaction of adjustment groups and trials ($p<.005$).

Table 4

Analysis of Variance for Words Correct and in Correct Position on the Normal Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	2094.52	8.74*****
Ss/ A	21	239.73	
Within			
Order (C)	1	72.60	4.19
A x C	2	9.45	.54
Ss x C/ A	21	17.35	
Trials (T)	4	391.54	45.90******
A x T	8	31.72	3.72*****
Ss x T/ A	84	8.53	
C x T	4	2.46	.64
A x C x T	8	8.33	2.16
Ss x C x T/ A	84	3.85	

***** $p<.005$
****** $p<.001$

Once again, the results of the analysis of words correct regardless of position generally concurred with the results of scoring words correct and in their correct position (Table 5). On the normal sentences, there was a significant difference between the three adjustment groups ($p<.005$). Examination of the means by the Sheffé method revealed a significant difference between the means of the poor premorbids and the normals ($p<.05$), and between the means of the good premorbids and the normals ($p<.005$), each in the expected direction. The poor premorbids and good premorbids were not significantly different. Again, the interaction of groups and trials was significant ($p<.001$).

The results of the analysis performed for the semantically anomalous sentences showed a significant difference between the three adjustment groups ($p<.005$) on the scoring of words correct and in correct position (Table 6). Comparison of the adjustment group means revealed that the poor premorbid schizophrenics were significantly different from the normals ($p<.025$) and that the good premorbids were also significantly different from the normals ($p<.01$) with the normals scoring higher in each case. There was no significant difference between the poor and good premorbid schizophrenics. Also, the interaction between groups and trials was not significant. The results of the analysis using the scoring of words correct regardless of position (Table 7) exactly duplicated the scoring of words correct and in correct position, including significance levels.

Table 5

Analysis of Variance for Words Correct Regardless of Position on the Normal Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	2138.64	9.46*****
Ss/ A	21	225.99	
Within			
Order (C)	1	70.42	3.88
A x C	2	10.28	.57
Ss x C/ A	21	18.14	
Trials (T)	4	395.06	47.32******
A x T	8	31.84	3.81******
Ss x T/ A	84	8.35	
C x T	4	2.45	.62
A x C x T	8	8.37	2.15
Ss x C x T/ A	84	3.89	

***** $p<.005$
****** $p<.001$

Table 6

Analysis of Variance for Words Correct and in Correct Position on the Anomalous Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	344.15	7.76*****
Ss/ A	21	44.34	
Within			
Order (C)	1	.15	.07
A x C	2	4.84	2.42
Ss x C/ A	21	2.00	
Trials (T)	4	39.64	12.61******
A x T	8	5.45	1.73
Ss x T/ A	84	3.14	
C x T	4	2.12	1.47
A x C x T	8	5.04	3.49*****
Ss x C x T/ A	84	1.45	

***** $p<.005$
****** $p<.001$

Table 7

Analysis of Variance for Words Correct Regardless of Position on the Anomalous Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	360.65	7.88*****
Ss/ A	21	45.76	
Within			
Order (C)	1	0.00	0.00
A x C	2	4.85	2.11
Ss x C/ A	21	2.30	
Trials (T)	4	39.64	12.07******
A x T	8	5.21	1.59
Ss x T/ A	84	3.28	
C x T	4	3.55	2.45
A x C x T	8	5.79	3.94******
Ss x C x T/ A	84	1.45	

***** $p<.005$
****** $p<.001$

On the analysis of the anagram strings using words correct and in correct position (Table 8), there was, again, a significant difference between the three adjustment groups ($p<.01$). There was a significant difference between the poor premorbids and the normals ($p<.001$) and the good premorbids and the normals ($p<.001$) in the expected direction. The poor premorbids and good premorbids, however, did not differ significantly. There was a significant interaction of adjustment groups and trials ($p<.001$). The analysis of anagram strings using words correct regardless of position produced similar but stronger results (Table 9). The three adjustment groups were significantly different ($p<.001$). Examination of the group means revealed that the poor premorbids and normals were significantly different ($p<.001$), the good premorbids and normals were significantly different ($p<.001$), but the poor premorbids and good premorbids were not significantly different. In addition, there was a significant interaction of groups and trials ($p<.001$) and of groups and order ($p<.01$).

Analysis of performance on the word lists showed no significant difference between the three adjustment groups using either method of scoring words correct (Tables 10 and 11). Indeed, there was no significant effect which involved the three groups, nor did any even approach significance.

Table 8

Analysis of Variance for Words Correct and in Correct Position on the Anagram Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	530.61	6.30****
Ss/ A	21	20.17	
Within			
Order (C)	1	23.44	3.64
A x C	2	21.65	3.36
Ss x C/ A	21	6.45	
Trials (T)	4	83.40	29.32******
A x T	8	16.39	5.76******
Ss x T/ A	84	2.84	
C x T	4	3.79	1.33
A x C x T	8	3.75	1.32
Ss x C x T/ A	84	2.85	

**** $p<.01$
****** $p<.001$

Table 9

Analysis of Variance for Words Correct Regardless of Position on the Anagram Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	1013.80	20.00******
Ss/ A	21	50.69	
Within			
Order (C)	1	87.60	8.33****
A x C	2	69.33	6.59****
Ss x C/ A	21	10.52	
Trials (T)	4	135.31	31.01******
A x T	8	35.65	8.17******
Ss x T/ A	84	4.36	
C x T	4	6.07	1.70
A x C x T	8	6.66	1.87
Ss x C x T/ A	84	3.57	

**** $p<.01$
****** $p<.001$

Table 10

Analysis of Variance for Words Correct and in Correct Position on the Word Lists

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	24.80	.72
Ss/ A	21	35.39	
Within			
Order (C)	1	28.70	11.25*****
A x C	2	3.30	1.29
Ss x C/ A	21	2.55	
Trials (T)	4	16.99	8.10******
A x T	8	.83	.39
Ss x T/ A	84	2.10	
C x T	4	.24	.19
A x C x T	8	3.55	2.87****
Ss x C x T/ A	84	1.24	

**** $p<.01$
***** $p<.005$
****** $p<.001$

Table 11

Analysis of Variance for Words Correct Regardless of Position on the Word Lists

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	26.34	.73
Ss/ A	21	35.92	
Within			
Order (C)	1	31.54	14.90******
A x C	2	4.16	1.97
Ss x C/ A	21	2.12	
Trials (T)	4	20.26	9.32******
A x T	8	1.04	.48
Ss x T/ A	84	2.17	
C x T	4	.17	.14
A x C x T	8	3.95	3.29*****
Ss x C x T/ A	84	1.20	

***** $p<.005$
****** $p<.001$

Analyses of Error Scores

The next series of analyses consisted of an examination of the number of inversion errors, bound-morpheme errors, and intrusion errors. An overall analysis of variance for each type of error was completed, followed by four subsequent analyses, one for each type of word string.

The overall analysis of the scores for inversion errors (Table 13) revealed a significant difference between the three adjustment groups ($p<.005$) and a significant interaction of groups and types of word string ($p<.001$). These are the only effects of any real interest in the original analyses. The analysis of inversion errors on each type of word string, however, failed to show significant differences between the three adjustment groups (Tables 14, 15, 16, 17, and 18), although the analysis of the anagram strings did approach the required significance level.

The initial analysis of bound-morpheme errors (Table 19) showed, once again, a significant difference between the three adjustement groups ($p<.005$) and a significant interaction of groups and types of word strings ($p<.01$). When analyses were performed on each type of word string, the analyses for normal sentences and for anomalous sentences (Tables 20 and 21) did not show significant differences between the three adjustment groups. On the other hand, there as a significant difference between the three

Table 12

Means and Standard Deviations of Words Correct and in Correct Position on Each Type of Word String for Poor and Good Premorbid Schizophrenics and Normals

Word String	Adjustment Group					
	Poor Premorbid		Good Premorbid		Normal	
	M	SD	M	SD	M	SD
Normal Sentences	10.13	6.40	6.35	4.12	16.47	6.89
Anomalous Sentences	3.65	2.06	3.06	2.16	6.91	3.37
Anagram Strings	3.34	1.56	4.41	2.34	8.24	3.50
Word Lists	3.60	1.93	3.09	1.57	4.20	3.00

Table 13

Analysis of Variance for Inversion Errors Over All Types of Word Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	46.3760	6.4627*****
Word Strings (B)	3	84.2233	11.7368******
A x B	6	34.9774	4.8742******
Ss/ A x B	84	7.1760	
Within			
Order (C)	1	6.1760	5.2813
A x C	2	4.3010	3.6780
B x C	3	7.4843	6.4001******
A x B x C	6	4.9385	4.2231*****
Ss x C/ A x B	84	1.1694	
Trials (T)	4	4.9974	8.4103******
A x T	8	1.6286	2.7408*****
B x T	12	2.9585	4.9790******
A x B x T	24	1.8012	3.0313******
Ss x T/ A x B	336	0.5942	
C x T	4	0.3297	.8228
A x C x T	8	0.3531	.8812
B x C x T	12	0.4435	1.1068
A x B x C x T	24	0.4679	1.1677
Ss x C x T/ A x B	336	0.4007	

**** $p<.01$
***** $p<.005$
****** $p<.001$

Table 14

Analysis of Variance for Inversion Errors on the Normal Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	2.02	1.00
Ss/ A	21	2.03	
Within			
Order (C)	1	.50	3.15
A x C	2	.23	1.35
Ss x C/ A	21	.16	
Trials (T)	4	.16	.46
A x T	8	.16	.45
Ss x T/ A	84	.35	
C x T	4	.26	1.24
A x C x T	8	.15	.70
Ss x C x T/ A	84	.21	

Table 15

Analysis of Variance for Inversion Errors on the Anomalous Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	.20	1.70
Ss/ A	21	.12	
Within			
Order (C)	1	.10	.93
A x C	2	.12	1.04
Ss x C/ A	21	.11	
Trials (T)	4	.08	1.13
A x T	8	.10	1.40
Ss x T/ A	84	.07	
C x T	4	.20	3.28
A x C x T	8	.12	1.93
Ss x C x T/ A	84	.06	

Table 16

Analysis of Variance for Inversion Errors on the Anagram Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	148.89	5.74
Ss/ A	21	25.94	
Within			
Order (C)	1	28.02	6.64
A x C	2	18.58	4.40
Ss x C/ A	21	4.22	
Trials (T)	4	13.29	7.68******
A x T	8	6.66	3.85******
Ss x T/ A	84	1.73	
C x T	4	.97	.89
A x C x T	8	.87	.79
Ss x C x T/ A	84	1.11	

****** $p<.001$

Table 17

Analysis of Variance for Inversion Errors on the Word Lists

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	.20	.33
Ss/ A	21	.62	
Within			
Order (C)	1	.01	.02
A x C	2	.20	1.10
Ss x C/ A	21	.19	
Trials (T)	4	.34	1.51
A x T	8	.12	.51
Ss x T/ A	84	.23	
C x T	4	.22	1.02
A x C x T	8	.63	2.87****
Ss x C x T/ A	84	.22	

**** $p<.01$

Table 18

Means and Standard Deviations of Inversion Errors on Each Type of Word String for Poor and Good Premorbid Schizophrenics and Normals

Word String	Adjustment Group					
	Poor Premorbid		Good Premorbid		Normal	
	M	SD	M	SD	M	SD
Normal Sentences	.06	.24	.34	.68	.34	.87
Anomalous Sentences	.09	.28	.04	.19	.14	.34
Anagram Strings	.56	.95	.61	.86	2.95	3.41
Word Lists	.21	.47	.30	.56	.30	.51

Table 19

Analysis of Variance for Bound-Morpheme Errors

Over All Types of Word Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	25.3969	6.5189*****
Word Strings (B)	3	97.9677	25.1463******
A x B	6	12.7260	3.2665****
Ss/ A x B	84	3.8959	
Within			
Order (C)	1	0.1260	.0696
A x C	2	1.8635	1.0298
B x C	3	1.8316	1.0121
A x B x C	6	1.6565	.9154
Ss x C/ A x B	84	1.8096	
Trials (T)	4	5.0625	8.0179******
A x T	8	0.5297	.8389
B x T	12	2.4798	3.9275******
A x B x T	24	1.1158	1.7672
Ss x T/ A x B	336	0.6314	
C x T	4	2.1729	2.6619
A x C x T	8	1.0667	1.3067
B x C x T	12	0.6249	.7655
A x B x C x T	24	0.6685	.8189
Ss x C x T/ A x B	336	0.8163	

**** $p<.01$
***** $p<.005$
****** $p<.001$

Table 20

Analysis of Variance for Bound-Morpheme Errors on the Normal Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	6.90	1.00
Ss/ A	21	6.91	
Within			
Order (C)	1	.02	.01
A x C	2	.63	.33
Ss x C/ A	21	1.89	
Trials (T)	4	3.30	4.11*****
A x T	8	.85	1.06
Ss x T/ A	84	.80	
C x T	4	2.01	1.93
A x C x T	8	1.09	1.06
Ss x C x T/ A	84	1.04	

***** $p<.005$

Table 21

Analysis of Variance for Bound-Morpheme Errors on the Anomalous Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	.38	1.17
Ss/ A	21	.33	
Within			
Order (C)	1	.60	3.17
A x C	2	.11	.59
Ss x C/ A	21	.19	
Trials (T)	4	.39	1.32
A x T	8	.36	1.23
Ss x T/ A	84	.30	
C x T	4	.04	.17
A x C x T	8	.19	.86
Ss x C x T/ A	84	.22	

groups for bound-morpheme errrors on the anagram strings (Table 22). Examination of the group means (Table 24) revealed that the poor premorbids were significantly different from the normals ($p<.01$), and the good premorbids were significantly different from the normals ($p<.10$), but the poor premorbids and good premorbids were not significantly different. In the case of each significant result, the normals scored higher and, thus, committed more bound-morpheme errors than either schizophrenic group. The analysis of bound-morpheme errors on the word lists (Table 23) also showed a significant difference between the three groups ($p<.005$). Examination of the group means revealed that the poor premorbids were significantly different from the normals ($p<.025$) and the good premorbids were significantly different from the normals ($p<.005$), with the normals committing more bound-morpheme errors in each case. The poor and good premorbids, on the other hand, were not significantly different.

Regarding intrusion errors, there were no significant differences between the three adjustment groups, nor were there any significant interactions of adjustment groups with any other variable (Table 25). Usually, subsequent analyses would not be performed following a negative result. However, the subsequent analyses were performed to round out the statistical procedure (Tables 26, 27, 28, 29, and 30).

Nevertheless, no differences between the three adjustment groups reached the required level of significance.

Table 22

Analysis of Variance for Bound-Morpheme Errors on the Anagram Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	45.84	6.45****
Ss/ A	21	7.10	
Within			
Order (C)	1	2.40	.56
A x C	2	6.09	1.45
Ss x C/ A	21	4.27	
Trials (T)	4	7.85	6.92******
A x T	8	2.38	2.10
Ss x T/ A	84	1.13	
C x T	4	1.15	.67
A x C x T	8	1.60	.93
Ss x C x T/ A	84	1.72	

**** $p < .01$
****** $p < .001$

Table 23

Analysis of Variance for Bound-Morpheme Errors on the Word Lists

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	10.45	8.41*****
Ss/ A	21	1.24	
Within			
Order (C)	1	2.60	2.93
A x C	2	.01	.01
Ss x C/ A	21	.89	
Trials (T)	4	.96	3.31
A x T	8	.28	.96
Ss x T/ A	84	.29	
C x T	4	.85	2.96
A x C x T	8	.19	.66
Ss x C x T/ A	84	.29	

***** $p<.005$

Table 24

Means and Standard Deviations of Bound-Morpheme Errors on Each Type of Word String for Poor and Good Premorbid Schizophrenics and Normals

Word String	Adjustment Group					
	Poor Premorbid		Good Premorbid		Normal	
	M	SD	M	SD	M	SD
Normal Sentences	.75	.98	1.34	1.51	1.04	1.20
Anomalous Sentences	.24	.51	.31	1.84	.17	4.12
Anagram Strings	1.01	1.34	1.51	1.38	2.50	1.82
Word Lists	.35	.59	.20	.43	.89	.89

Table 25

Analysis of Variance for Intrusion Errors Over All Types of Word Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	10.0906	.4825
Word Strings (B)	3	26.5083	1.2675
A x B	6	23.0864	1.1039
Ss/ A x B	84	20.9144	
Within			
Order (C)	1	0.9375	.3882
A x C	2	3.0969	1.2825
B x C	3	3.4903	1.4454
A x B x C	6	0.6537	.2707
Ss x C/ A x B	84	2.4148	
Trials (T)	4	12.7786	5.4442******
A x T	8	1.1349	.4835
B x T	12	2.8217	1.2022
A x B x T	24	2.4309	1.0357
Ss x T/ A x B	336	2.3472	
C x T	4	2.0495	1.1085
A x C x T	8	2.8573	1.5454
B x C x T	12	1.9008	1.0281
A x B x C x T	24	2.4367	1.3179
Ss x C x T/ A x B	336	1.8489	

****** $p < .001$

Table 26

Analysis of Variance for Intrusion Errors on the Normal Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	8.13	.20
Ss/ A	21	41.08	
Within			
Order (C)	1	.20	.07
A x C	2	.70	.25
Ss x C/ A	21	2.79	
Trials (T)	4	6.26	1.95
A x T	8	3.87	1.21
Ss x T/ A	84	3.20	
C x T	4	1.96	1.24
A x C x T	8	1.59	1.01
Ss x C x T/ A	84	1.58	

Table 27

Analysis of Variance for Intrusion Errors on the Anomalous Sentences

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	19.43	1.13
Ss/ A	21	17.19	
Within			
Order (C)	1	4.54	1.64
A x C	2	.99	.36
Ss x C/ A	21	2.76	
Trials (T)	4	3.93	1.37
A x T	8	1.56	.54
Ss x T/ A	84	2.87	
C x T	4	3.07	.92
A x C x T	8	2.64	.79
Ss x C x T/ A	84	3.34	

Table 28

Analysis of Variance for Intrusion Errors on the Anagram Strings

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	41.50	3.93
Ss/ A	21	10.57	
Within			
Order (C)	1	2.40	.97
A x C	2	3.24	1.31
Ss x C/ A	21	2.46	
Trials (T)	4	2.25	1.43
A x T	8	1.24	.79
Ss x T/ A	84	1.57	
C x T	4	2.00	1.94
A x C x T	8	2.79	2.70
Ss x C x T/ A	84	1.04	

Table 29

Analysis of Variance for Intrusion Errors on the Word Lists

Source	Degrees of Freedom	Mean Squares	F
Between			
Groups (A)	2	10.29	.69
Ss/ A	21	14.82	
Within			
Order (C)	1	4.27	2.60
A x C	2	.13	.08
Ss x C/ A	21	1.64	
Trials (T)	4	8.81	5.05*****
A x T	8	1.76	1.01
Ss x T/ A	84	1.74	
C x T	4	.71	.50
A x C x T	8	3.14	2.18
Ss x C x T/ A	84	1.44	

***** $p<.005$

Table 30

Means and Standard Deviations of Intrusion Errors on Each Type of Word String for Poor and Good Premorbid Schizophrenics and Normals

Word String	Adjustment Group					
	Poor Premorbid		Good Premorbid		Normal	
	M	SD	M	SD	M	SD
Normal Sentences	1.93	2.56	2.54	1.99	2.23	2.64
Anomalous Sentences	2.67	2.40	2.06	2.29	1.70	1.29
Anagram Strings	1.54	1.60	.74	1.06	2.17	1.78
Word Lists	1.73	1.59	1.66	1.63	2.31	1.87

Discussion

In general, the results of the three different methods of scoring for correctness were in agreement. On the subsequent analyses particularly, the scoring of words correct regardless of position tended to produce even greater differences between the three treatment groups. Although these three methods cannot be considered to be completely independent of one another, the consistency of the results over the three methods tends to give greater confidence to the findings. The error scores, which were included solely as a secondary measure, in conformance with the basic Marks and Miller (1964) procedure, tended to produce somewhat equivocal and even apparently contradictory findings which will be discussed later. The major emphasis will, of course, be placed on the primary measure, scorings for correctness, which reflects most accurately the semantic and syntactic components as varied in the construction of the four types of word strings.

Taking the three methods of scoring for correctness as a whole, the first result of interest was a significant difference between the three adjustment groups on the original analyses. This result, together with the significant interaction of adjustment groups and types of word strings, was of interest primarily as an indication that the performances of the three groups should be examined

more closely by means of the subsequent analyses. Interpretation of results from the original analyses will not be emphasized since each result can be discussed more fully and meaningfully by examination of the subsequent analyses. The same is true of the interaction between groups and trials.

Turning, then, to the subsequent analyses, a good starting point would be the analysis of performance on the word lists. The word lists, as mentioned earlier, were constructed by scrambling the word order of the anomalous sentences, thus preserving neither the syntactic nor the semantic components of the original normal sentences. Thus, the task constitutes a simple immediate recall problem using groups of unrelated words. It was not expected that such a task would significantly differentiate the three adjustment groups, and, indeed, it did not. Neither of the measures of words correct even approached significance. This finding agrees essentially with the Lawson, McGhie, and Chapman (1964) study, which used the Miller and Selfridge materials. They, too, found no significant difference between schizophrenics and normals on the passages which consisted of randomly selected words, either ten or twenty words in length. Also, in the Lewinsohn and Elwood (1961) study which used the Miller and Selfridge 20 word lists, there was no difference between acute schizophrenics and normals on the random words, although the chronic schizophrenics scored somewhat lower. When the

groups were matched for vocabulary scores, this difference, too, disappeared. Thus, the lack of significance between the three adjustment groups in the present study is in agreement with previous work as well as meeting the expectation of the present study.

It was particularly important for the three groups to perform at essentially the same level on the word lists in order to make interpretations of differences in performance on the other types of word strings. Since a basic immediate recall method was employed to measure performance on all types of word strings, it was important to demonstrate that any differences in performance between the three adjustment groups was not confounded by an inability on the part of the schizophrenics to listen to verbal materials and record what they could recall. Indeed, the lack of difference between the three groups on the word lists as shown in Fig. 1 would indicate that any differences between the three groups on the other types of strings would not be due to a basic memory deficit, but, rather, to some language deficit which is the focus of the present study.

The subsequent analyses of the anagram strings, in contrast to the word lists, produced several significant findings at high levels of confidence. The most important of these is the significant difference between the three adjustment groups. The anagram strings, constructed by taking each of the normal sentences and carefully scrambling

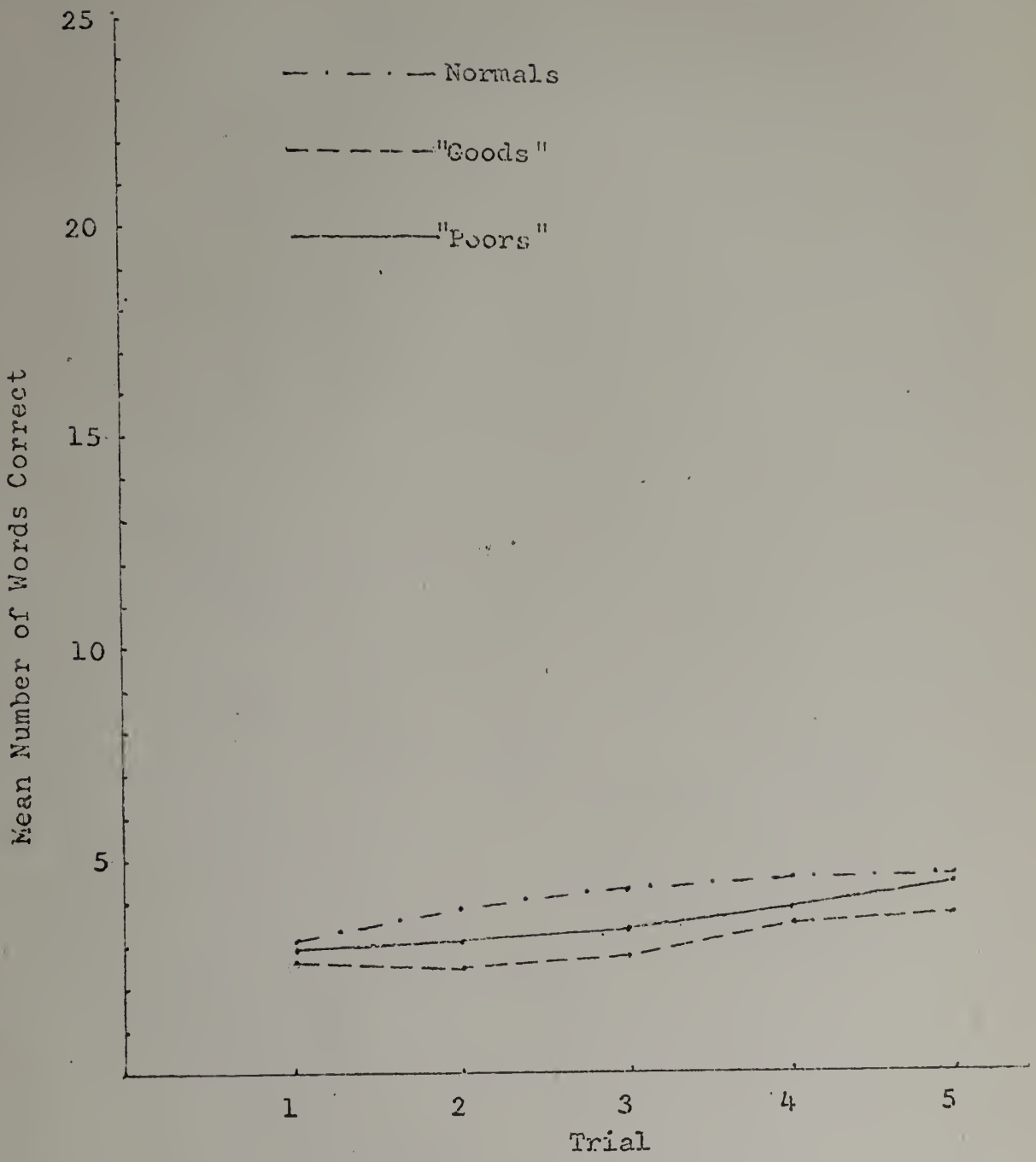

Fig. 1. Mean number of words correct and in correct position for each adjustment group over five trials on the word lists.

the word order, retained the semantic component in that all the words may be meaningfully grouped together, but eliminated the syntactic component. Looking at the relative performance of the three adjustment groups, both measures of words correct showed significant differences between each schizophrenic group and the normals, but no significant difference between the good premorbids and the poor premorbids. The normals, as expected, recalled more words correctly. Since the three groups were not significantly different on the word lists which retained neither the semantic nor the syntactic component, and since the schizophrenics and normals were significantly different on the anagram strings which retained the semantic component, then it can be concluded that the semantic component of language represents an area of deficit for the schizophrenics. In other words, the normals apparently were able to take advantage of the presence of the semantic component to improve their performance over what would be seen on a recall task using unrelated words. In contrast to the normals, the schizophrenics were relatively unable to take advantage of the presence of the semantic component, and thus scored significantly lower.

When discussing the language behavior of people, the semantic and syntactic components must be viewed as more than rules of language. As Miller (1966) has noted, these are, at best, implicit rules since people follow them with

amazing skill while often completely unable to provide an explicit statement of them. He felt that such implicit rules could be best described as habits. Applying this observation to the results of the anagram strings, the normals, it seems, were able to transfer the appropriate semantic habits from normal language to the experimental task and, thus, improved their performance. The schizophrenics, with inadequate semantic habits, were comparatively unable to do likewise.

Examination of the test materials tends to indicate that the theory proposed by Chapman (1964) is not sufficient to explain the deficit shown by the schizophrenics on the anagram strings. Chapman felt that the schizophrenic's difficulty with the semantic component of language stemmed primarily from an excessive reliance on the "stronger portions" of the denotation of a word, i.e., the most common meaning, with a relative neglect of the weaker meaning. The words used in the present study are almost exclusively used in the sense of their most common meaning. Nevertheless, the schizophrenics were unable to make use of these meanings (the semantic component) to assist the recall of the words presented.

Some of Moran's (1953) findings would seem closer to explaining the results of the anagram strings analysis. He, too, felt that schizophrenics at least have available to them the common definitions of words but show an impairment

in their ability to use the words in thinking and communication. His conclusions stem from findings which indicate a lower ability on the part of the schizophrenics to form concepts with the words in his study, a lower ability to reason symbolically with the words, differences in their associations to the words, as well as other differences in word usage. These findings have been generally substantiated in a wealth of concept formation and word association studies with schizophrenics. Taking these findings as a whole, and noting especially the schizophrenics' deviant associations to words and, presumably, between words, it would seem that the schizophrenic is less able to use the associations which exist among the words of an anagram string. He is, therefore, less able to perceive that the words might be meaningfully grouped together and, thus, be retained more easily.

The significant interaction of adjustment groups and trials is important in that it tends to reinforce the conclusions drawn from the overall differences between the three groups on the anagram strings. Looking at the patterns of responding over the five trials (Fig. 2), it would seem that the two groups of schizophrenics performed somewhat similarly with an overall increase in number of words recalled from the first to the fifth trial. The normals, however, showed a much greater amount of increase over the five trials, which accounted for the significant interaction.

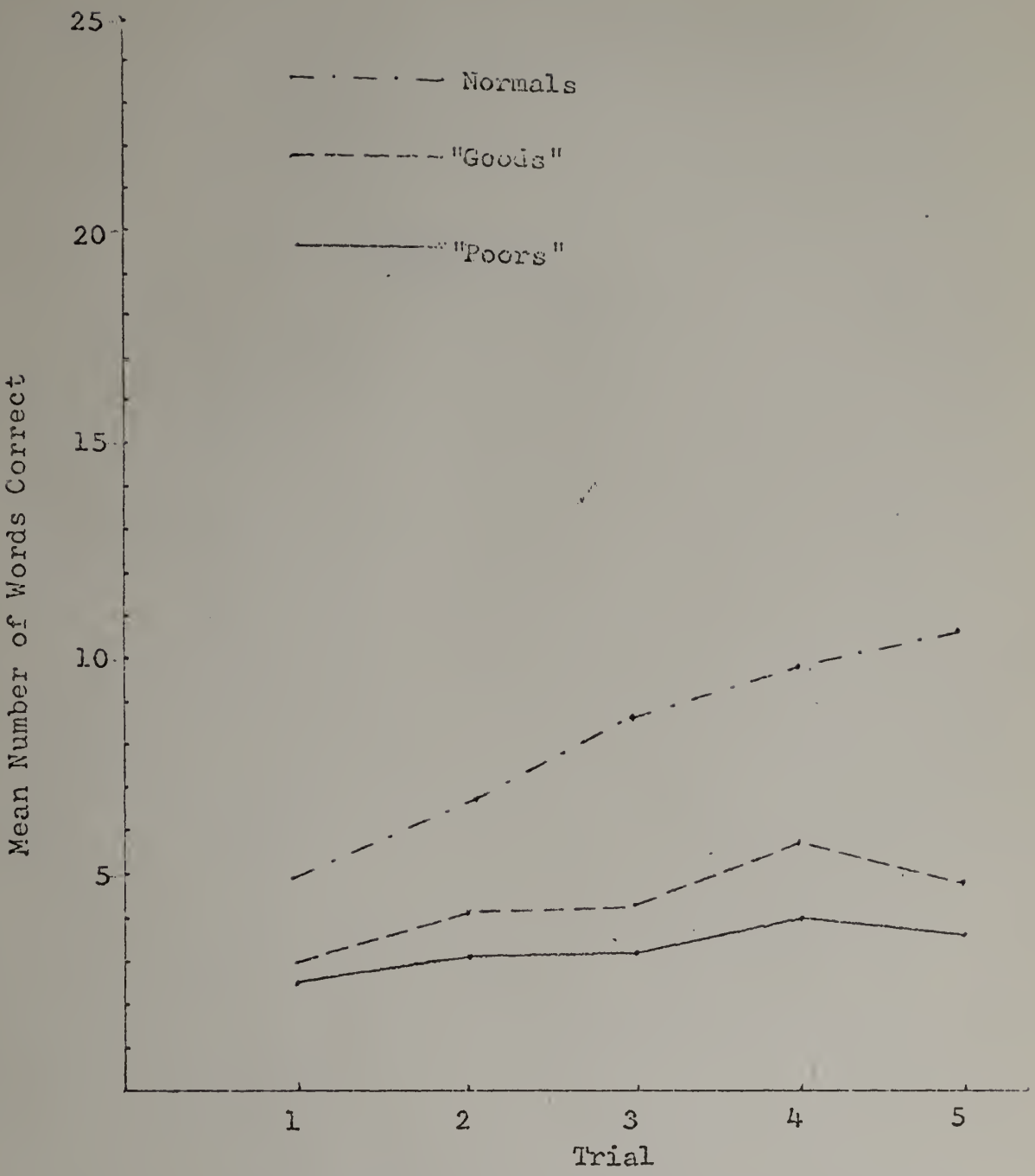

Fig. 2. Mean number of words correct and in correct position for each adjustment group over five trials on the anagram strings.

Thus, not only were the normals able to take advantage of the presence of the semantic component to recall words correctly, when considering performance as a whole, but they were able to do so increasingly over the course of the five trials, in contrast to the schizophrenics who were able to make only moderate gains. Similarly, the significant interaction of groups and order seen on the words correct regardless of position measure would indicate that the normals were not only comparatively more able to use the semantic component to improve their performance over five trials, but were also able to use it to improve performance from the first presentation of anagram strings to the second presentation. In other words, the normals showed a greater warm-up effect than the schizophrenics. The later interpretation must be viewed with some caution since the interaction of groups and order was not significant on the words correct and in correct position measure.

The subsequent analysis of the anomalous sentences, once again, showed a significant difference between the three adjustment groups. The two methods of scoring words correct produced identical results. The anomalous sentences were derived from the normal sentences by taking the first word from the first sentence, the second word from the second sentence, and so on. Thus, they retain the syntactic component while eliminating the semantic component. As expected, the three adjustment groups were significantly

different, with the normals scoring significantly higher than the poor premorbid or good premorbid schizophrenics. The interpretation of this result follows a similar line to that of the anagram strings. Since the schizophrenics were substantially less able to take advantage of the presence of the syntactic component to recall more words correctly in comparison to the normals, then it would seem that the syntactic component would represent a major area of language deficit for the schizophrenics. Although a good deal of attention has been paid to the semantic component, either directly through vocabulary studies or less directly through verbal concept formation studies, very little emphasis has been placed on the syntactic component of schizophrenic language. It should be noted that the language of normal conversation is not always completely grammatically correct, but, is often composed of sentence fragments and grammatically erroneous phrases which are, nevertheless, understood within the context of the situation. So, too, in the clinical observations of schizophrenic language, which were based primarily on spoken language, e.g., Bleuler (1950), Arieti (1955), a disruption of the syntactic component was not readily noticed. Rather, emphasis was placed on the glaring disruption of the semantic component. Even in experimental studies of schizophrenic language, the experimental task would usually require little or no syntactic structure, e.g., Moran (1953), Salzinger et al. (1963).

Although a disruption in the syntactic component in schizophrenic language has not been emphasized thus far, it is by no means surprising to find such a disruption documented by the current findings. As Laffal (1965) pointed out, syntax is important psychologically insofar as it contributes to meaning by placing emphasis, pointing directions of action and modification, establishing sequences and relationships, and otherwise organizing words. Almost a defining characteristic of schizophrenia is disorganization. It seems possible that a good deal of the disorganization which is noted in the language of schizophrenics could be attributed to a disruption in the syntactic component which is the main contributor of organization and structure to language. Even analytically oriented interpretations of schizophrenic language would agree that if the peculiarities are due to primary process distortions comparable to the distortions of dreams, then there would also be a breakdown of the logical ordering and structure usually contributed by the syntactic components of language and replacement with more primitive modes of combining language elements, in addition to the semantic disturbances already noted.

The importance of the structuring aspect of the syntactic component for schizophrenic language is particularly evident in regard to the study by Salzinger, Portnoy, and Feldman (1963). They felt that the fairly coherent speech of their schizophrenic Ss which followed closely after the

instructions and introductory remarks was due to the structure provided by those instructions and remarks. However, when this structure was no longer present, the speech of the schizophrenics became more difficult to understand. Considering the finding of the present study which revealed a disruption in the syntactic component, it seems possible that the observations of Salzinger et al. could be explained as follows. If the schizophrenic is no longer able to depend upon an external source of structure for his language and must produce his own structure, he will be relatively unable to do so because of the disruption of the syntactic component of his language which should be the source of such structure. Thus, his language becomes unstructured, disorganized, and generally less understandable to the listener.

The subsequent analyses of the normal sentences again showed significant differences between the schizophrenics and the normals in the expected direction. The normal sentences consisted of simple declarative statements composed of relatively low frequency words. Most important is the fact that the normal sentences contained both the semantic and syntactic components of language. The analyses of the anagram strings and of the anomalous sentences documented disturbances in the semantic and syntactic components respectively in the language of schizophrenics. The differences in performance on the normal sentences

demonstrated that the disturbances are present when both components are represented in their natural form. This result would tend to discredit the possibility that the lowered performance of the schizophrenics might be due to the unfamiliarity and increased difficulty of the anagram strings and anomalous sentences.

As with the anagram strings, there was a significant interaction of adjustment groups and trials on the normal sentences. Again, this interaction tends to reinforce the conclusions drawn from the overall differences between the groups. Examination of performances over the five trials (Fig. 3) indicated that the two schizophrenic groups were relatively less able to take advantage of the presence of both the syntactic and semantic components to increase the number of words recalled from the first to the fifth trial.

At this point, it should be noted that, while a significant interaction of groups and trials was found on the normal sentences and anagram strings, there was no such significant interaction on the anomalous sentences (Fig. 4). None, of course, was expected on the word lists. However, one similarity of the word lists and the anomalous sentences is the lack of the semantic component. In the anagram strings, on the other hand, the words can be assimilated into what Miller (1966) described as a rather small semantic field. In other words, they can be grouped together on the basis of their meaning regardless of any structure or

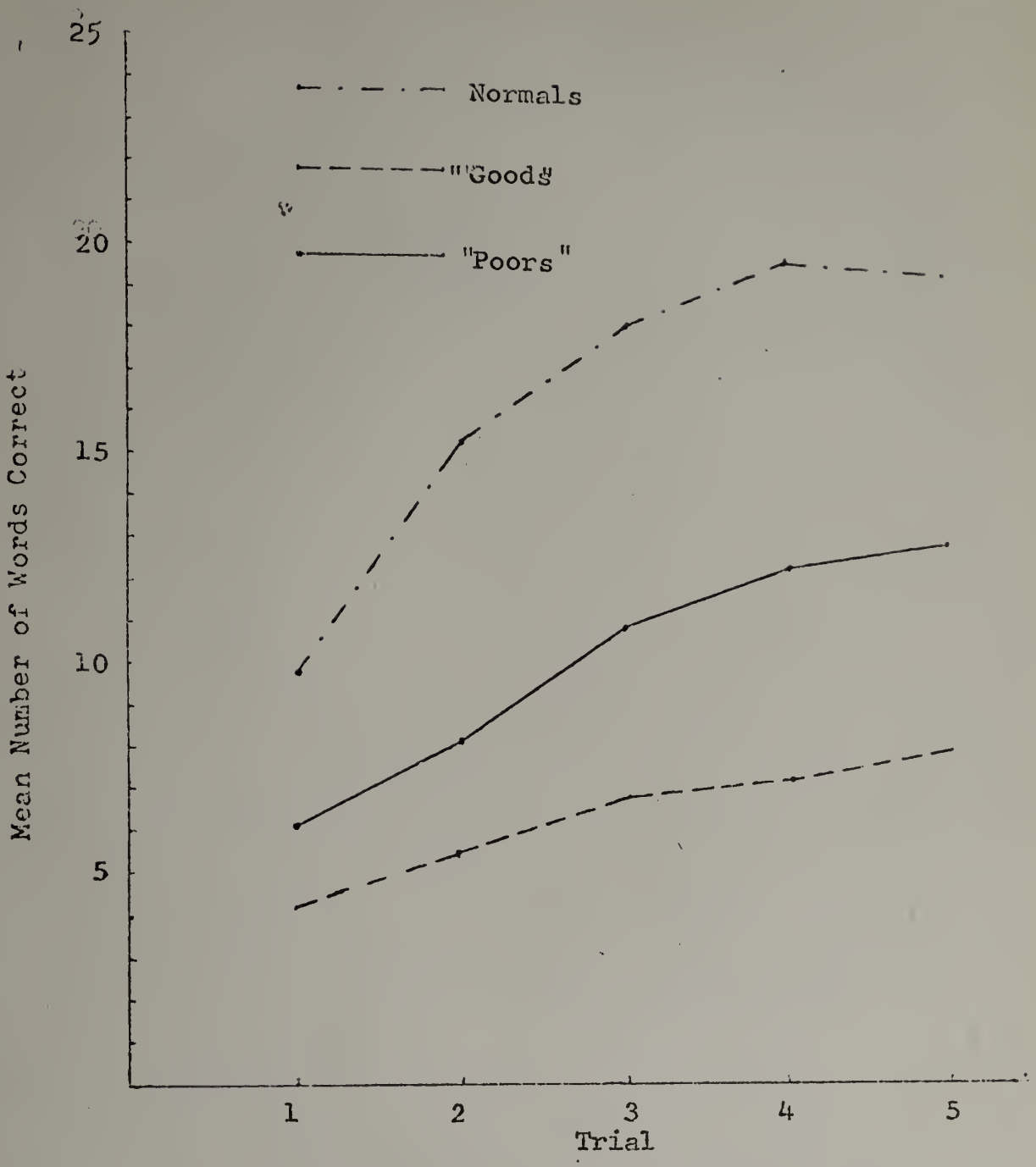

Fig. 3. Mean number of words correct and in correct position for each adjustment group over five trials on the normal sentences.

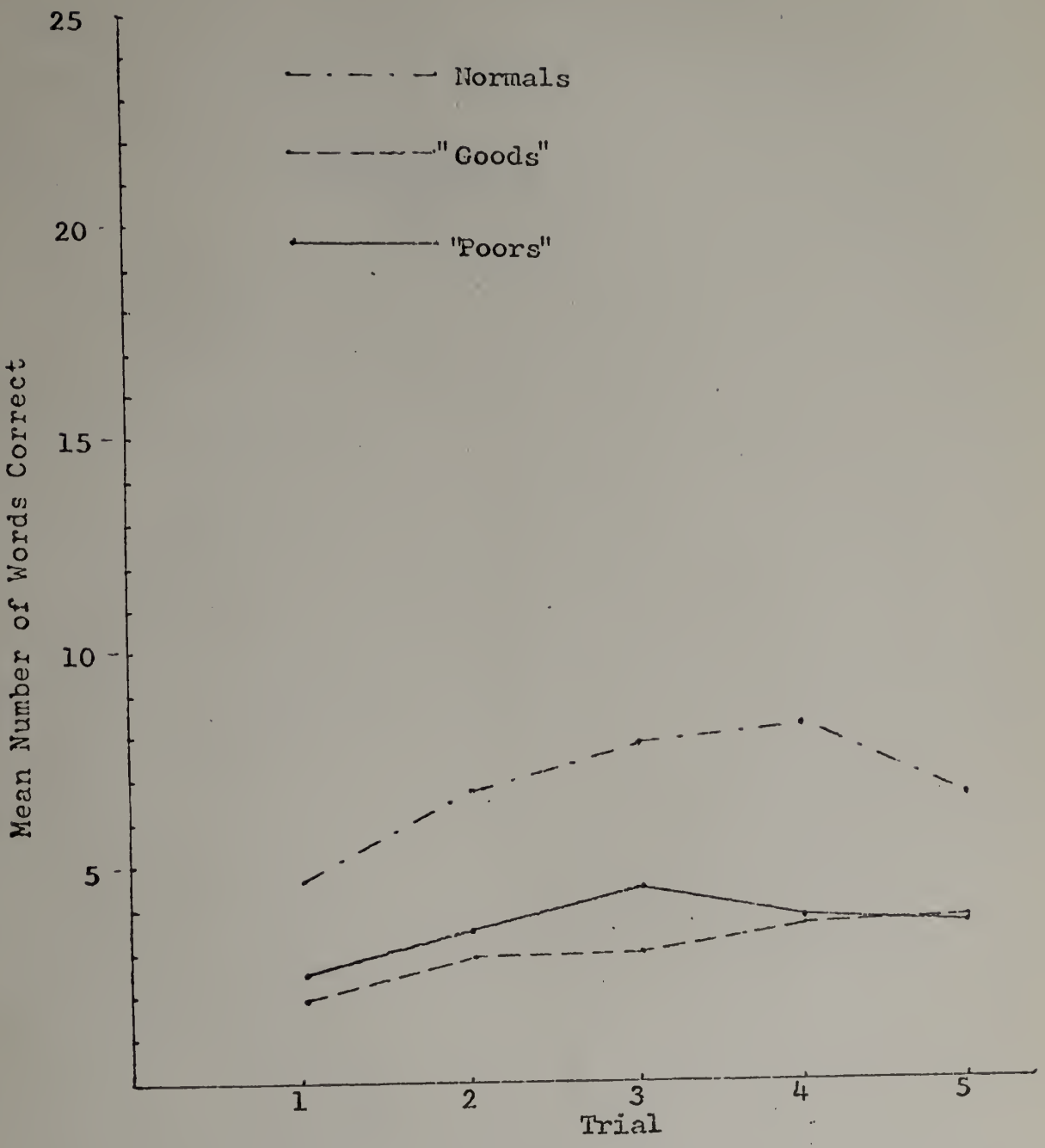

Fig. 4. Mean number of words correct and in correct position for each adjustment group over five trials on the anomalous sentences.

ordering. The semantic field does not even have to include all five words in a string to be of assistance in recalling words. If a S could only perceive a semantic field as small as two words such as "jewelers respectable", it would be of assistance in remembering each of the individual words. The anomalous sentences, of course, did not contain words which could be meaningfully grouped together. It would appear, then, that without the presence of at least a semantic field, which is the semantic component in a more primitive form than is usually seen in language, the normals were no more able to improve their performance over trials than were the schizophrenics. This might tend to confirm Laffal's opinion that the essence of language lies in meaning and, therefore, the semantic component is the most vital.

Although the primary measures of performance used in the study, i.e., the two measures of scoring words correct, produced very strong and meaningful results, the secondary measures, scoring three types of error, were not especially fruitful and were, at times, apparently contradictory. They were used as an additional measure in keeping with the original Marks and Miller (1964) procedure. As with the scoring for words correct, the original analyses were of interest primarily as an indication of whether the performance of the three groups should be examined more closely by means of analyses at each type of word string. The original analysis of the intrusion errors, however, showed

no significant difference between the three groups, nor was there a significant interaction of groups and types of word strings. Intrusion, as mentioned earlier, is defined as the introduction of a word into a string that does not belong in it. Intrusions are considered to be semantic errors since they are related to decisions as to which words may combine in a sentence. Since the lack of difference between the three groups would imply no difference between the schizophrenics and the normals with respect to the semantic component of language, this result must be weighed against the very strong finding on the words correct analyses of the anagram strings. Obviously, the later is more dependable since it is derived directly from the design of the experimental task, while the measure of intrusion errors is somewhat indirect.

Regarding inversion errors, the original analysis did show a significant difference between the three adjustment groups and a significant interaction of groups and types of word strings. An inversion is defined as the misplacing of a word within a string and inversions are considered to be syntactic errors since they are related to word order. The subsequent analyses of inversion errors on each type of word string showed no significant differences on either the normal sentences, anomalous sentences, or the word lists. Only the analysis on the anagram strings approached significance. Again, the results from an error score were not in agreement

with the very strong results of the analyses of words correct. Of course, the question is raised as to the validity of inversion errors as a measure of the syntactic component. At the most basic level, one could interpret the two findings as showing that, while the schizophrenics may be deficient in the syntactic component of language as shown by the analysis of words correct on the anomalous sentences, this deficiency is not manifested by a confusion of word order.

Like inversions, bound-morpheme errors are considered to be syntactic errors. A bound-morpheme error refers to the omission or incorrect addition of prefixes and suffixes. They are considered syntactic errors because they center around grammatical tags. The overall analysis of bound-morpheme errors produced the significant differences between the adjustment groups and the significant interaction of groups and types of word strings which led to analyses at each type of word string. The analysis of bound-morpheme errors on the normal sentences and on the anomalous sentences did not show significant differences between the three groups. On the anagram strings and the word lists, however, the three groups were significantly different but not in the predicted direction. On these two types of word strings, the normals committed more bound-morpheme errors than the two schizophrenic groups. Thus, like the inversion and the intrusion error scores, the scoring of bound-morpheme errors produced seemingly contradictory results.

It should be noted, though, that the normals committed more bound-morphemes syntactic errors only on strings in which there was no syntactic component. Nevertheless, the question remains as to why the normals are more inclined to do so than the schizophrenics. Judging from the impressively greater number of words recalled correctly on the normal sentences, anomalous sentences, and the anagram strings by the normal subjects, and comparing this with the results of the error scores, it would seem that the errors committed by the schizophrenics might be primarily errors of omission in which they are simply unable to recall a word as presented. The normals, on the other hand, made their errors in the process of attempting to recall the test material.

Turning to the results as a whole, it should be noted that on none of the analyses of any of the various measures were the poor premorbid schizophrenics and the good premorbid schizophrenics significantly different. It was originally expected that the good premorbids would score significantly higher than the poor premorbids, based primarily on previous studies in areas such as concept formation, e.g., Acres (1963). Considering the major findings of the current study, it would appear that the disruptions of the semantic and syntactic factors of language are equally pervasive in both groups of schizophrenics. It should be noted, however, that the good premorbids were, generally, seen during a more acute phase of their

disturbance. Testing these patients at a later period might have altered the results somewhat since good premorbids are characterized by relatively rapid improvement (Phillips, 1953).

As mentioned earlier, when discussing the language behavior of people, the semantic and syntactic components can be best described as habits. Thus, we can talk in terms of extremely complex linguistic habits which are acquired from early childhood through a long process of social interaction. In the case of the poor premorbid schizophrenic with his long history of inadequate interpersonal relationships, it would seem that he never had sufficient opportunity to acquire the appropriate syntactic and semantic habits. The good premorbid schizophrenic, on the other hand, seems to have acquired sufficient semantic and syntactic habits to communicate adequately throughout most of his life. If, however, these habits were acquired through stressful or even traumatic social interactions, then it seems reasonable to speculate that these habits would be particularly vulnerable to breakdown during the later period of severe internal and external stress.

As Miller (1966) observed from his work with normal subjects, "Every time I have tried to explore the psychological reality of syntactic and semantic rules, I have found them to have large and important effects on the behavior of my subjects." How much greater and more important, then,

are the effects of a deficit in the semantic and syntactic components of language for the schizophrenic patient? The most serious effect, of course, is an inability to communicate effectively with other human beings. The results of the present study, however, might suggest ways of overcoming such a communications barrier. The presence of the deficit in the semantic component would indicate that, when one attempts to communicate with the schizophrenic patient, the words used should be relatively common ones with little ambiguity in their meaning. Abstract words and phrases should be avoided. Also, noting the syntactic deficit, statements should be short and should have a simple grammatical structure. Such a procedure might provide a model which the patient would be able to follow in reestablishing communication. Indeed, future research might be directed towards testing the effectiveness of such a procedure which takes into account the semantic and syntactic deficits while attempting to both give information to and receive information from the schizophrenic patient.

Summary

The purpose of this study was to investigate schizophrenic language in terms of two factors, the semantic component and the syntactic component, which have been shown to be meaningful in studies of language with normal Ss. An immediate recall task using auditory verbal stimuli (Marks and Miller, 1964) was used. It could independently vary the semantic and syntactic components by means of four types of word strings, i. e., normal sentences, semantically anomalous sentences, anagram strings, and word lists. Ss consisted of two groups of schizophrenics, poor premorbids and good premorbids, as well as a group of normals recruited from the community at large. The three groups of 32 male Ss were matched for age, WAIS Vocabulary subtest scores, and education.

Six methods of scoring the data were used. A word was scored as correct only if was recalled in its correct position within a word string. A second method scored a word as correct regardless of the position in which it was recalled. Also, the number of total strings correct was scored. Finally, the number of inversions, bound-morpheme errors, and intrusions were scored.

The results from the first three methods of scoring for correctness were generally in agreement. There were no significant differences between the three adjustment groups

on the word lists, which consisted of strings of unrelated words, indicating that differences in performance on the other types of word string were not due to a basic memory deficit on the part of the schizophrenics or an inability to deal with the experimental task. On the anagram strings, which retained the semantic component while eliminating the syntactic component, each of the schizophrenic groups scored significantly lower than the normals, although the two schizophrenic groups were not differentiated. This result was viewed as indicating a comparative inability on the part of the schizophrenics to make use of the presence of the semantic component to improve their performance and seemed to indicate that this is an area of deficit for them. Similarly, on the semantically anomalous sentences which retained the syntactic component while eliminating the semantic, the normals scored significantly higher than either schizophrenic group. Again, the two schizophrenic groups were not differentiated. This result indicated that the syntactic component might also be an area of deficit for the schizophrenic. On the normal sentences which retained both the semantic and the syntactic components in their natural form, the two schizophrenic groups again performed significantly lower than the normal groups, but with no significant difference between the two schizophrenic groups. Each of these findings was discussed in terms of

current theories of language in schizophrenia, particularly those emphasizing word meaning and structure.

Analyses of the three types of error scores failed to show significant differences between the three adjustment groups. The error scores were, however, secondary measures and the major emphasis was placed on the more direct and reliable measures of number of words recalled correctly. Finally, some implications for improving communication with the schizophrenic patient were drawn.

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Appendix

Table 31

The Two Sets of Materials

Set I

Normal Sentences:

Rapid flashes augur violent storms.

Pink bouquets emit fragrant odors.

Fatal accidents deter careful drivers.

Melting snows cause sudden floods.

Noisy parties wake sleeping neighbors.

Anomalous Sentences:

Rapid bouquets deter sudden neighbors.

Pink accidents cause sleeping storms.

Fatal snows wake violent odors.

Melting parties augur fragrant drivers.

Noisy flashes emit careful floods.

Anagram Strings:

Rapid augur violent flashes storms.

Bouquets pink odors fragrant emit.

Deter drivers accidents fatal careful.

Sudden melting cause floods snows.

Neighbors sleeping noisy wake parties.

Word Lists:

Rapid deter sudden bouquets neighbors.

Accidents pink storms sleeping cause.

Wake odors snows fatal violent.

Fragrant melting augur drivers parties.

Floods careful noisy emit flashes.

Table 31, cont'd.

Set II

Normal Sentences:

Furry wildcats fight furious battles.

Respectable jewelers give accurate appraisals.

Lighted cigarettes create smoky fumes.

Gallant gentlemen save distressed damsels.

Soapy detergents dissolve greasy stains.

Anomalous Sentences:

Furry jewelers create distressed stains.

Respectable cigarettes save greasy battles.

Lighted gentlemen dissolve furious appraisals.

Gallant detergents fight accurate fumes.

Soapy wildcats give smoky damsels.

Anagram Strings:

Furry fight furious wildcats battles.

Jewelers respectable appraisals accurate give.

Create fumes cigarettes lighted smoky.

Distressed gallant save damsels gentlemen.

Stains greasy soapy dissolve detergents.

Word Lists:

Furry create distressed jewelers stains.

Cigarettes respectable battles greasy save.

Dissolve appraisals gentlemen lighted furious.

Accurate gallant fight fumes detergents.

Damsels smoky soapy give wildcats.